Experience Sharing Seminar for Food Testing Laboratories (Online)

The role of Government Laboratory in supporting the testing industry through provision of proficiency testing schemes and production of reference materials

8 Dec 2022

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Chemist / Strategic Development Section
Government Laboratory

Roles of Government Laboratory

- The Government Laboratory of the HKSAR Government (GLHK) provides a wide range of scientific services to various government departments to support the maintenance of
  - law and order
  - public health and safety
  - environmental protection
  - protection of consumer interests
  - protection of revenue

Clients

- **Environment and Ecology Bureau**
  - Food and Environmental Hygiene Department (Centre for Food Safety)
  - Agriculture, Fisheries and Conservation Department
  - Environmental Protection Department
  - Hong Kong Observatory
- **Health Bureau**
  - Department of Health
- **Security Bureau**
  - Hong Kong Police Force
  - Customs & Excise Department
  - Fire Services Department
  - Immigration Department
- **Other Government Departments**
  - Labour Department
  - Innovation & Technology Commission
  - Social Welfare Department
- **Statutory bodies**
  - Hospital Authority, etc.

Other roles of Government Laboratory

- **Serves as a Designated Institute (for metrology in chemistry) for Hong Kong, China**
  - **Participation in international comparisons**
    - Participated in >90 comparison studies
    - 105 CMCs covering various test areas including food and environment
  - **Production of certified reference materials (CRM)**
    - Produced 10 CRMs
  - **Provision of proficiency testing (PT) schemes**
    - Organized 76 PTs
  - **Technical seminars**
    - Actively organize technical seminars for both local and other international and regional organizations

Establishment of Strategic Development (SD) Section

A purposely established research and development section in **2009** which aims

1. to support other operational sections of the Laboratory through provision of urgent analytical services, and
2. to disseminate the usefulness of chemical metrology activities in advancement of measurement sciences and in **providing support to the development of local certification and testing industry**.

Responsibilities of Strategic Development (SD) Section

The key responsibilities are:

- Anticipating and responding to emergency incidents
- Initiating research and development projects
- Organizing local, regional and international **proficiency testing** programs
- Organizing regional and international chemical metrology programs
- Developing and preparing **reference materials**

Provision of Proficiency Testing Schemes in Hong Kong

- HOKLAS accredited Proficiency Testing Provider (PTP) since 2009
- In accordance with international standard ISO 17043:2010
- Organized over 50 PTs since 2009
- Examples:

Boric Acid in Food

Propionic Acid in Flour Confectionary

Inorganic Arsenic in Aquatic Product

Hong Kong Accreditation Service
香港認可處

Certificate of Accreditation
認可證書

This is to certify that
特此證明

GOVERNMENT LABORATORY - Analytical and Advisory Services Division

政府化驗所 - 分析及諮詢事務部

7/F., Homantin Government Offices, 88 Chung Hau Street, Kowloon, Hong Kong
香港九龍何文田忠孝街八十八號何文田政府合署七樓

has been accepted by the HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a
在認可諮詢委員會的建議下獲香港認可處執行機關接受為

HOKLAS Accredited Proficiency Testing Provider
「香港實驗所認可計劃」認可能力驗證提供者

This Proficiency Testing Provider meets the requirements of ISO/IEC 17043:2010 and it has been accredited for providing specific proficiency testing schemes as listed in the scope of accreditation
此能力驗證提供者符合ISO/IEC 17043:2010所訂的要求並獲認可提供載於認可範圍的指定能力驗證計劃

The common seal of the Hong Kong Accreditation Service is affixed hereto by the authority of the HKAS Executive
現經香港認可處執行機關授權在此蓋上香港認可處的印章

WONG Wang-wah, Executive Administrator
執行幹事 黃宏華
Issue Date : 26 February 2015
簽發日期：二零一五年二月二十六日

Registration Number : HOKLAS 001
註冊號碼：

Date of First Registration : 14 March 1986
首次註冊日期：一九八六年三月十四日

This certificate is issued subject to the terms and conditions laid down by HKAS
本證書按所香港認可處訂立的條款及條件發出

L001334

Scope of Accreditation on PTP

Chemical Testing:	
Chinese Medicine	(a) Organochlorine Pesticide Residues (b) Elements
Environmental	Sediment: Polynuclear Aromatic Hydrocarbons
Food	**(a) Elements** (b) Malachite Green (c) Melamine (d) Organochlorine Pesticide Residues (e) Radionuclides: ^{131}I, ^{134}Cs and ^{137}Cs **(f) Boric Acid** **(g) Propionic Acid in Flour Confectionery**
Toxicology	Drugs in Biological Matrix: Ketamine in hair

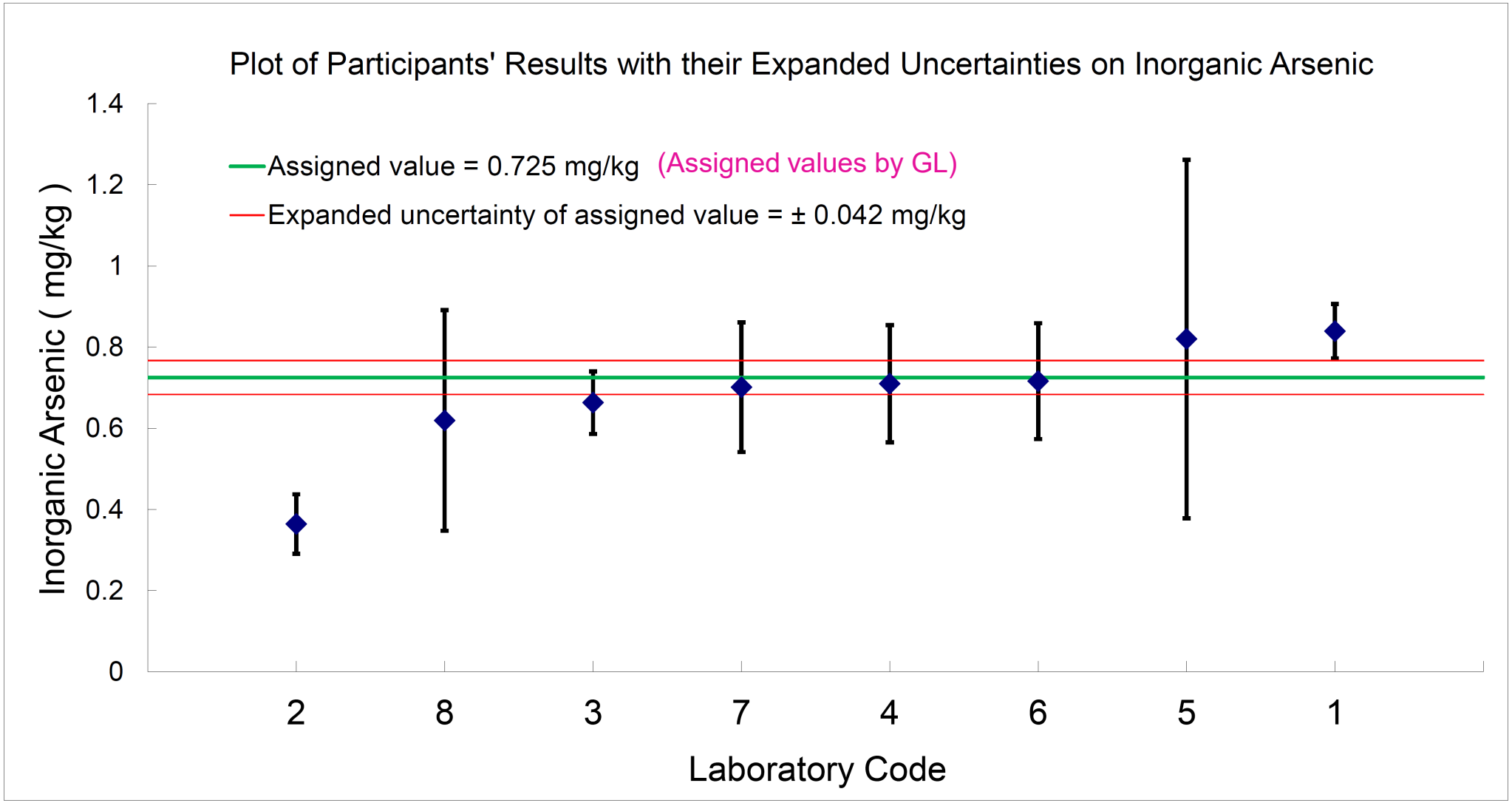
Provision of Proficiency Testing Schemes 提供能力驗證

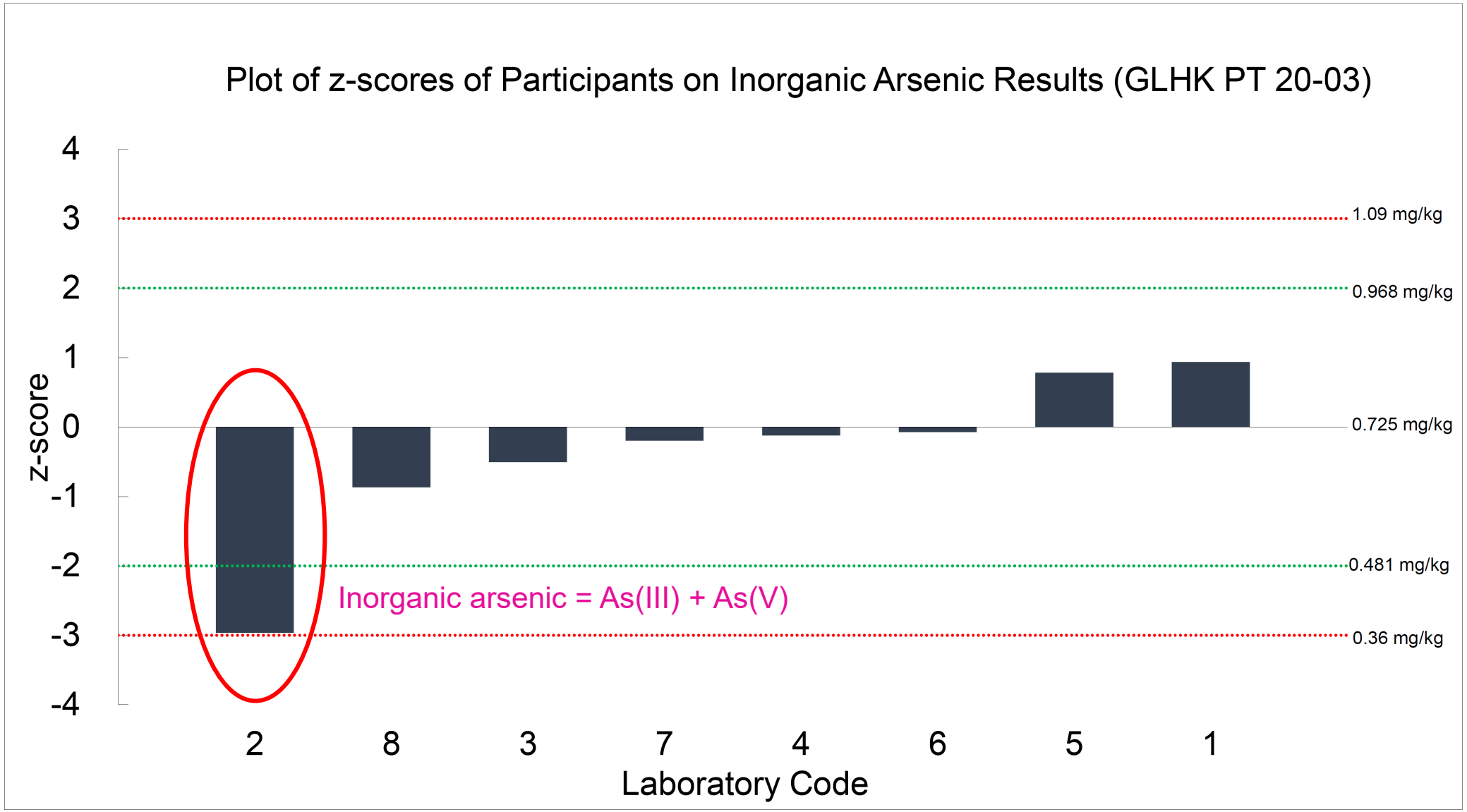
PROFICIENCY TESTING SCHEME AND ITEM 能力驗證計劃及項目	MEASURAND OR CHARACTERISTIC MEASURED 測試參數或特質	PROFICIENCY TESTING SCHEME PROCEDURE* 能力驗證計劃程序
Government Laboratory Proficiency Testing Scheme	Chemical testing: - Chinese Medicine - (a) Organochlorine pesticide residues (b) Elements Environmental - Sediment: Polynuclear aromatic hydrocarbons Food - (a) Elements (b) Malachite Green (c) Melamine (d) Organochlorine pesticide residues (e) Radionuclides : Iodine-131 Cesium-134 Cesium-137 (f) Boric acid (g) Propionic acid in flour confectionery Toxicology - Drugs in biological matrix	Protocol for Proficiency Testing Scheme (PTPP)

PT Schemes organized in recent years (2016 – now)

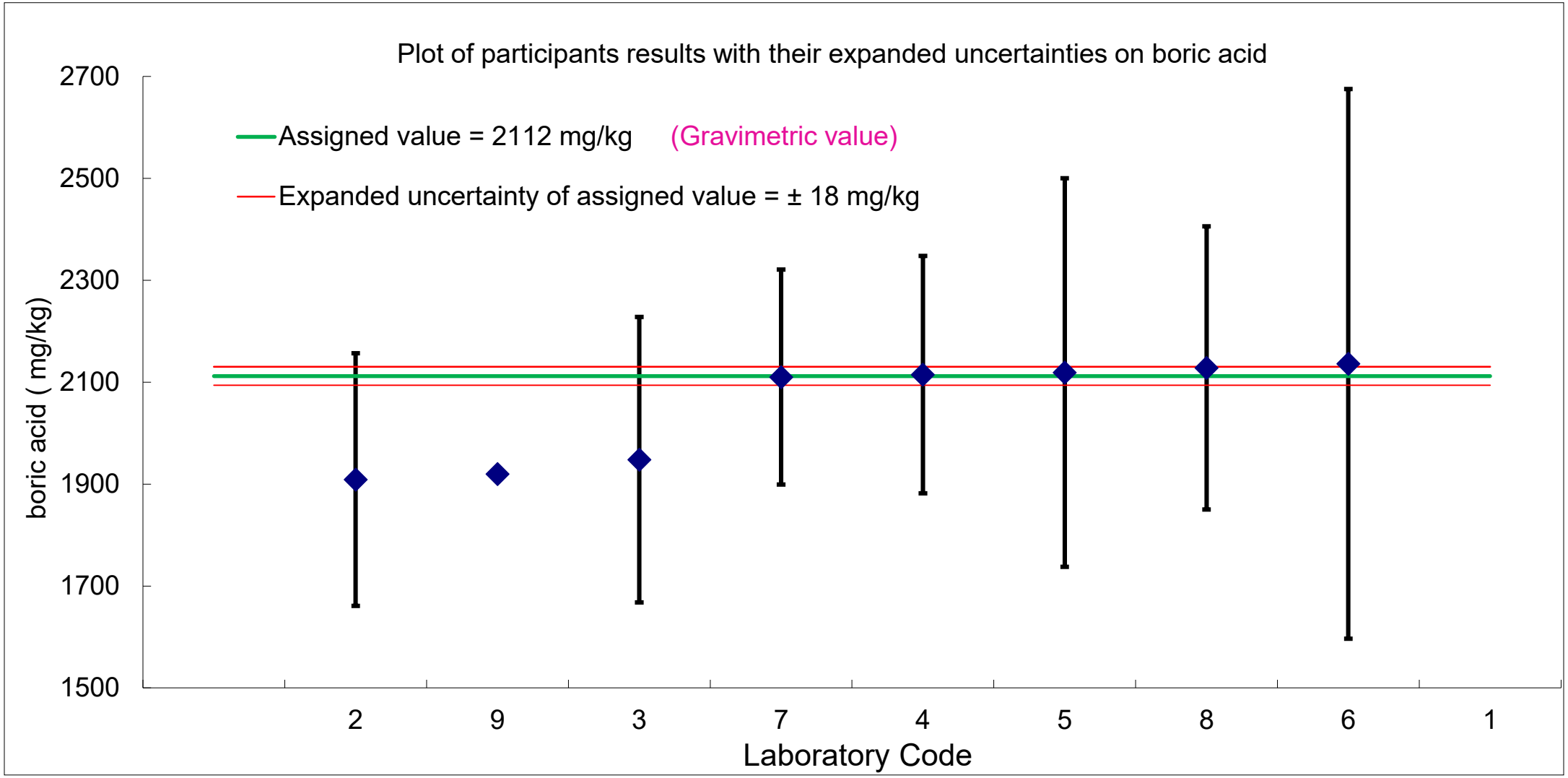
Area	Proficiency Testing Programme	Completion Year
Chinese Medicine	Chemical Markers in Chinese Medicinal Oil	2022, 2020
	Assay of Chinese Materia Medica	2021, 2019, 2018, 2017
Food Safety	Benzoic Acid in Fish Sauce	2022
	Boric Acid in Food	**2022**, 2021, 2020, 2019, 2018, 2017, 2016
	Propionic Acid in Flour Confectionery	**2022**, 2021, 2020, 2019, 2018, 2017, 2016
	Inorganic Arsenic in Aquatic Product	In progress, **2021**, 2019

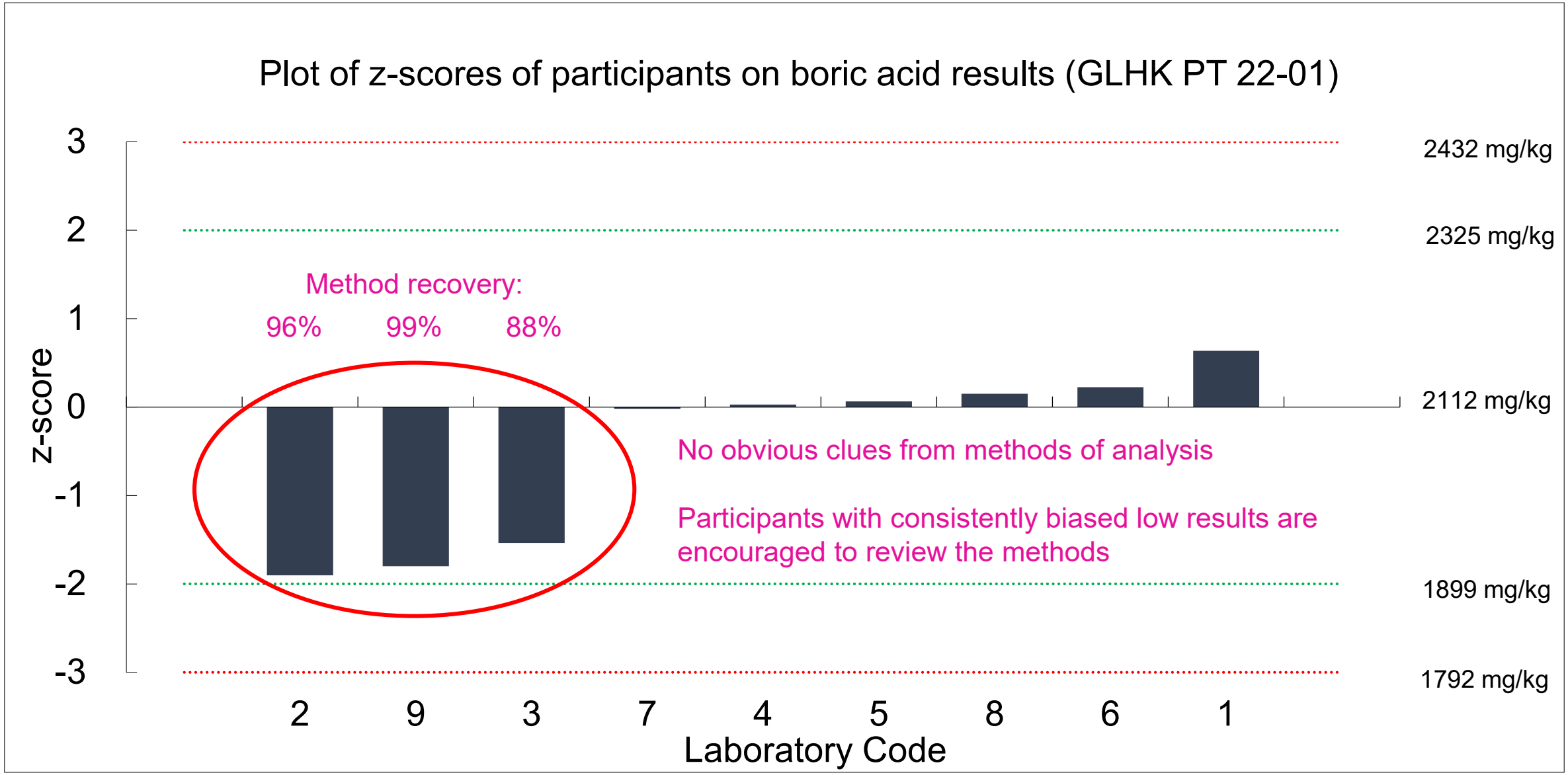
Inorganic Arsenic in Aquatic Product (GLHK PT 20-03)



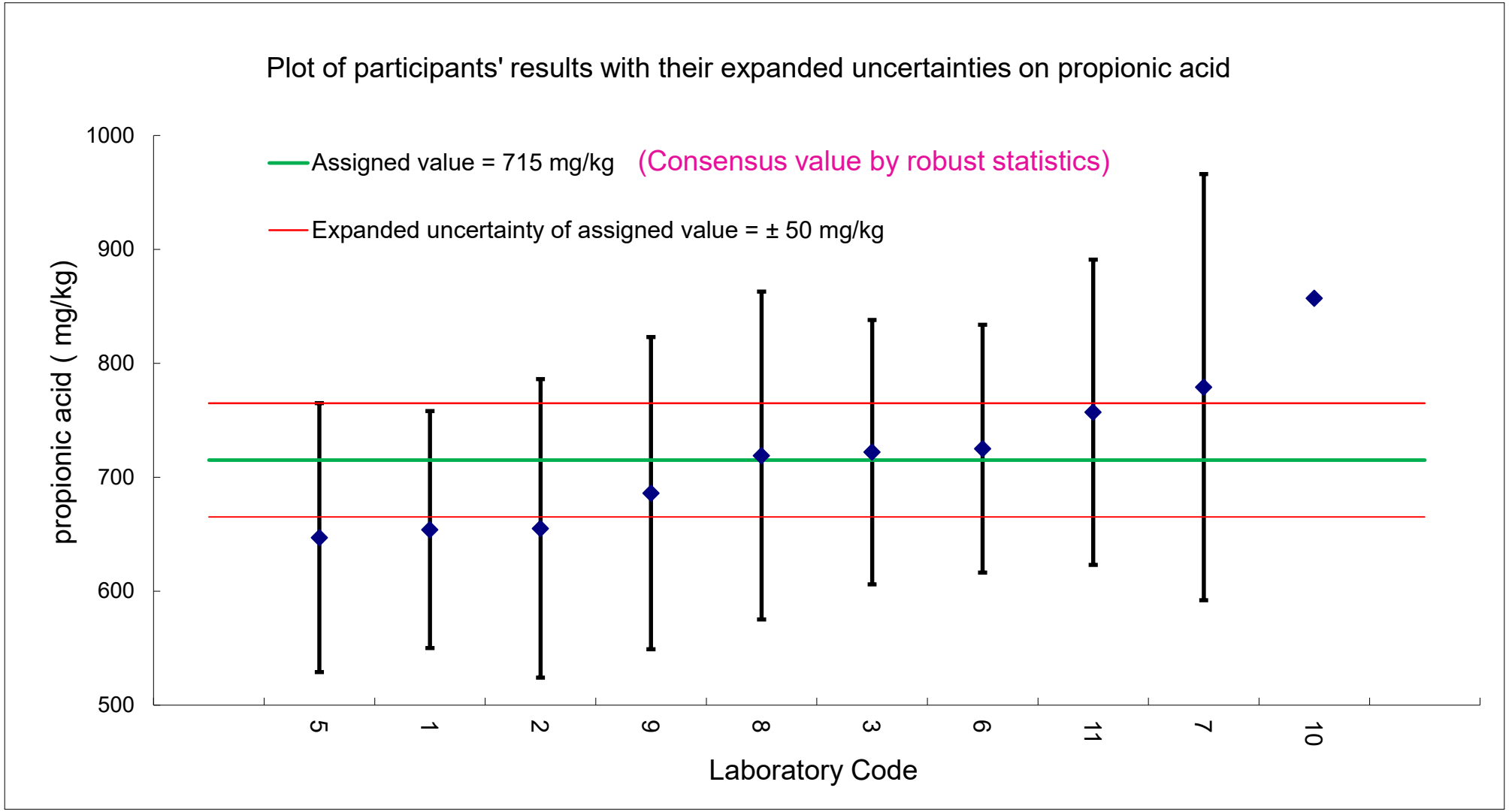

Plot of z-scores of Participants on Inorganic Arsenic Results (GLHK PT 20-03)
z-score
4
3
2
1
0
-1
-2
-3
-4
1.09 mg/kg
0.968 mg/kg
0.725 mg/kg
0.481 mg/kg
0.36 mg/kg
Inorganic arsenic = As(III) + As(V)
2
8
3
7
4
6
5
1
Laboratory Code

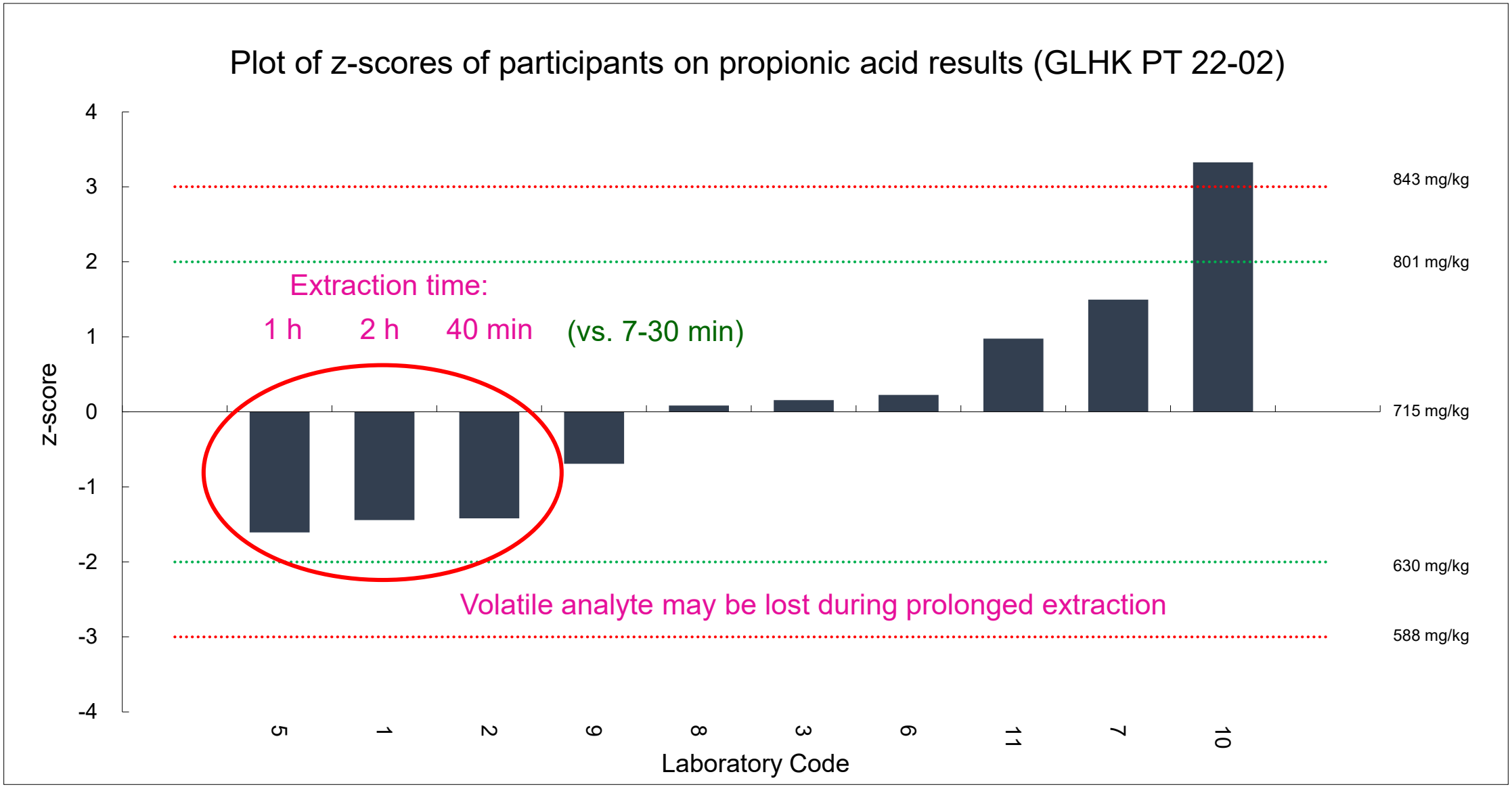
Boric Acid in Food (GLHK PT 22-01)




Plot of z-scores of participants on boric acid results (GLHK PT 22-01)
3
2
1
0
-1
-2
-3
z-score
2432 mg/kg
2325 mg/kg
2112 mg/kg
1899 mg/kg
1792 mg/kg
Method recovery:
96%
99%
88%
No obvious clues from methods of analysis
Participants with consistently biased low results are encouraged to review the methods
2
9
3
7
4
5
8
6
1
Laboratory Code

Propionic Acid in Flour Confectionery (GLHK PT 22-02)




Plot of z-scores of participants on propionic acid results (GLHK PT 22-02)
z-score
4
3
2
1
0
-1
-2
-3
-4
843 mg/kg
801 mg/kg
715 mg/kg
630 mg/kg
588 mg/kg
Extraction time:
1 h
2 h
40 min
(vs. 7-30 min)
Volatile analyte may be lost during prolonged extraction
5
1
2
9
8
3
6
11
7
10
Laboratory Code

Boric Acid in Food (GLHK PT 23-01) & Propionic Acid in Flour Confectionery (GLHK PT 23-02)

Tentative schedule	Action
December 2022 - January 2023	Call for Participation, deadline of registration, sample dispatch
February 2023	Deadline of Result Submission
March – Apr 2023	Distribution of Final Report

Note the following change for Propionic Acid in Flour Confectionery:

	GLHK PT 22-02 (previous round)	**GLHK PT 23-02 (new round)**
Method for determination of assigned value	Consensus value by robust statistics	**IDMS by GLHK**

Preparation of PT Sample

Raw material 原材料

Spiking of analyte 摻加分析物

Blending 打碎及混合

Freeze-drying 凍乾

Homogenising 均勻化

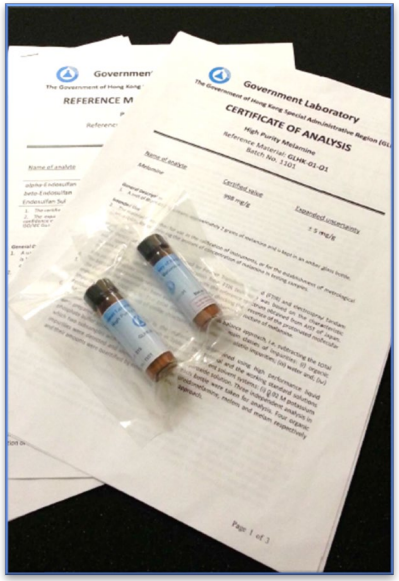
Bottling 裝瓶

Reference Material Production

	PT sample (ISO 13528)	CRM (ISO Guide 35)
Between-bottle homogeneity	✓	✓
Within-bottle homogeneity		✓
Short-term stability	usually 35°C, 3 days	up to 60 °C, 6 weeks
Long-term stability	2 points	Min. 4 points
Repeated subsampling stability		✓
Shelf-life estimation		✓
Post-production stability monitoring		✓

Reference Material Producer

- Accredited reference material producer (RMP) since 2010
- Produced 10 Certified Reference Materials (CRMs) :
  - Chinese Medicine:
    - Cadmium and Lead in Herb
    - Trace and Essential Elements in *Herba Ecliptae*
    - Cypermethrin in Tea Leaf
    - Organochlorine Pesticides in Ginseng
  - Food:
    - Melamine in Milk
    - Pesticides in Tea
    - Elements in Seafood
    - Arsenic (total), Cadmium and Inorganic Arsenic in Rice
  - Pure Substance:
    - High Purity Melamine
    - High Purity Estradiol

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香港九龍何文田忠孝街八十八號何文田政府合署七樓

is accredited by the Hong Kong Accreditation Service (HKAS) to ISO 17034:2016 as a
獲香港認可處根據ISO 17034:2016認可為

Reference Material Producer
標準物質生產者

for the production of specific reference materials as listed in the scope of accreditation
就生產載於認可範圍內的指定標準物質

The common seal of HKAS is affixed hereto by the authority of the HKAS Executive
現經香港認可處執行總監授權在此蓋上香港認可處的印章

CHEN Kin-wah, Executive Administrator
執行幹事 陳健華
Issue Date : 3 January 2019
簽發日期：二零一九年一月三日

Registration Number : HOKLAS 001
註冊號碼：

Date of First Registration : 14 March 1986
首次註冊日期：一九八六年三月十四日

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L001751

Scope of Accreditation on RMP

Matrix	Reference material property	Range (uncertainties)	Approach used for property value assignment
Chinese Medicine - Botanical materials	Chemical elements: - Cadmium - Lead - Zinc - Nickel - Arsenic - Calcium	0.1 to 1 mg/kg (3–8 %) & 2 to 10 mg/kg (3–8 %) 0.5 to 5 mg/kg (4–8 %) & 1 to 10 mg/kg (4–8 %) 20 to 100 mg/kg (4–8 %) 10 to 50 mg/kg (4–8 %) 0.5 to 2 mg/kg (4–8 %) 2 to 100 mg/g (3–8 %)	Cd, Pb, Zn, Ni: ID-ICP-MS & GSA-ICP-MS As: GSA-ICP-MS Ca: GSA-ICP-AES
General foodstuff	Chemical elements: - Arsenic - Cadmium - Iron - Zinc	0.3 to 100 mg/kg (4–8 %) 0.2 to 10 mg/kg (3–8 %) 100 to 1000 mg/kg (3–8 %) 20 to 1000 mg/kg (3–8 %)	As: GSA-ICP-MS Cd, Fe, Zn: ID-ICP-MS & GSA-ICP-MS
Food of plant origin	**Toxic metal and metalloid species:** - **Total Arsenic** - **Cadmium** - **Inorganic Arsenic**	**0.05 to 100 mg/kg (4–8 %)** **0.2 to 10 mg/kg (3–8 %)** **0.1 to 10 mg/kg (8–12 %)**	**Total As: GSA-ICP-MS** **Cd: ID-HR-ICP-MS** **Inorganic As: IC-ICP-MS**

Scope of Accreditation on RMP

Matrix	Reference material property	Range (uncertainties)	Approach used for property value assignment
Food of plant origin	Pesticides: - Cypermethrin	100 to 500 μg/kg (13%)	GC-HRMS & GC-MS/MS
Food of plant origin	Pesticides: - Alpha-endosulfan - Beta-endosulfan - Endosulfan sulphate	100 to 1000 μg/kg (6–8%)	GC-NCI-MS & GC-EI-HRMS
Chinese medicine - Botanical materials	**Pesticides: – α-hexachlorocyclohexane – γ-hexachlorocyclohexane**	**10 to 1000 μg/kg (4–10%)**	**GC-NCI-MS & ID-GC-MS/MS**
Food - Diary products	Organic contaminants: - Melamine	0.5 to 5 mg/kg (7–8 %)	ID-LC-MS/MS & ID-GC-MS
Pure Substance	Melamine	95 to 100% purity (0.5%)	HPLC, LC-MS/MS, IR, GC-MS, ICP-MS, Karl Fischer coulometry
Pure Substance	**Estradiol**	**95 to 100% purity (0.5%)**	**HPLC, LC-MS, ICP-MS, GC-MS, Karl Fischer coulometry**

Reference Material Producers 生產標準物質者

MATRIX 種類	REFERENCE MATERIAL PROPERTY 標準物質的特性	PRODUCTION PLAN NAME 生產計劃名稱	UNCERTAINTY 不確定度 (U_{CRM})*	APPROACH USED FOR PROPERTY VALUES ASSIGNMENT 定值方法
Certified Reference Materials				
				Assigned values are determined experimentally using the following techniques:-
Chinese medicine -Botanical materials	Chemical elements: - Cadmium	RMPP		Isotope dilution inductively coupled plasma mass spectrometry (ID-ICP-MS), Gravimetric standard additions inductively coupled plasma mass spectrometry (GSA-ICP-MS) and Gravimetric standard additions inductively coupled plasma atomic emission spectrometry (GSA-ICP-AES)
	(0.1 to 1 mg/kg)		3 to 8%	
	(2 to 10 mg/kg)		3 to 8%	
	- Lead			
	(0.5 to 5 mg/kg)		4 to 8%	
	(1 to 10 mg/kg)		4 to 8%	
	- Zinc			
	(20 to 100 mg/kg)		4 to 8%	
	- Nickel			
	(10 to 50 mg/kg)		4 to 8%	
	- Arsenic			
	(0.5 to 2 mg/kg)		4 to 8%	
	- Calcium			
	(2 to 100 mg/kg)		3 to 8%	
General foodstuff	Chemical elements: - Arsenic	RMPP		Isotope dilution inductively coupled plasma mass spectrometry (ID-ICP-MS) and Gravimetric standard additions inductively coupled plasma mass spectrometry (GSA-ICP-MS)
	(0.3 to 100 mg/kg)		4 to 8%	
	- Cadmium			
	(0.2 to 10 mg/kg)		3 to 8%	
	- Iron			
	(100 to 1000 mg/kg)		3 to 8%	
	- Zinc			
	(20 to 1000 mg/kg)		3 to 8%	
Food of plant origin	Toxic metal and metalloid species	RMPP		
	- Total Arsenic			Inductively coupled plasma mass spectrometry (ICP-MS) with gravimetric standard addition
	(0.05 to 100 mg/kg)		4 to 8%	
	- Cadmium			Isotope dilution high resolution inductively coupled plasma mass spectrometry (ID-HR-ICP-MS)
	(0.2 to 10 mg/kg)		3 to 8%	
	- Inorganic Arsenic			Ion chromatography - Inductively coupled plasma mass spectrometry (IC-ICP-MS) with gravimetric standard addition
	(0.1 to 10 mg/kg)		8 to 12%	

* Expanded uncertainty of property a value (U_{CRM}) is expressed as a relative expanded uncertainty, calculated using coverage factor of 2, which gives a level of confidence of approximately 95%.

Reference Material Producers 生產標準物質者

MATRIX 種類	REFERENCE MATERIAL PROPERTY 標準物質的特性	PRODUCTION PLAN NAME 生產計劃名稱	UNCERTAINTY 不確定度 (U_{CRM})*	APPROACH USED FOR PROPERTY VALUES ASSIGNMENT 定值方法
Certified Reference Materials				
				Assigned values are determined experimentally using the following techniques:-
Food of plant origin	Pesticides: - Cypermethrin (100 to 500 µg/kg)	RMPP	13%	Isotope dilution gas chromatography- high resolution mass spectrometry (GC-HRMS) and Gas chromatography-tandem mass spectrometry (GC-MS/MS)
Food of plant origin	Pesticides: - Alpha-endosulfan (100 to 1000 µg/kg) - Beta-endosulfan (100 to 1000 µg/kg) - Endosulfan sulphate (100 to 1000 µg/kg)	RMPP	6 to 8% 6 to 8% 6 to 8%	Isotope dilution gas chromatography- negative chemical ionisation-mass spectrometry (GC-NCI-MS) and Gas chromatography electron impact-high resolution mass spectrometry (GC-EI-HRMS)
Chinese medicine - Botanical materials	Pesticides: - α-hexachlorocyclohexane (10 to 1000 µg/kg) - γ-hexachlorocyclohexane (10 to 1000 µg/kg)	RMPP	4 to 10% 4 to 10%	Isotope dilution gas chromatography- negative chemical ionisation-mass spectrometry (GC-NCI-MS) and Isotope dilution gas chromatography tandem mass spectrometry (ID-GC-MS/MS) [New CRM produced]
Food - Dairy products	Organic contaminants: - Melamine (0.5 to 5 mg/kg)	RMPP	7 to 8%	Isotope dilution liquid chromatography tandem mass spectrometry (ID-LC-MS/MS) and Isotope dilution gas chromatography- mass spectrometry (ID-GC-MS)
Pure substance	Melamine (Purity: 95 - 100%)	RMPP	0.5%	High performance liquid chromatography (HPLC) Liquid chromatography tandem mass spectrometry (LC-MS/MS) Infra-red spectrometry (IR) Gas chromatography mass spectrometry (GC-MS) Inductively coupled plasma mass spectrometry (ICP-MS) Karl Fischer coulometry
Pure substance	Estradiol (Purity: 95 - 100%)	RMPP	0.5%	High performance liquid chromatography (HPLC) and Liquid chromatography mass spectrometry (LC-MS) Inductively coupled plasma mass spectrometry (ICP-MS) Gas chromatography mass spectrometry (GC-MS) Karl Fischer coulometry Quantitative Nuclear Magnetic Resonance (qNMR) [New technique]

* Expanded uncertainty of property a value (U_{CRM}) is expressed as a relative expanded uncertainty, calculated using coverage factor of 2, which gives a level of confidence of approximately 95%.

Currently available CRMs

Code of CRM	Name of CRM	Matrix	Parameter(s)
GLHK-11-02	Melamine in Milk	Milk	Melamine
GLHK-11-03	Pesticides in Tea	Green tea leaves	α-Endosulfan β-Endosulfan
GLHK-01-01	High Purity Melamine	-	Melamine
GLHK-01-02	High Purity Estradiol	-	Estradiol
GLHK-11-29	Arsenic (total), Cadmium, and Inorganic Arsenic in Rice	Powered rice	Arsenic (total) Cadmium Inorganic arsenic
GLHK-10-15	Organochlorine Pesticides in Ginseng	Ginseng	α-hexachlorocyclohexane (α-BHC) γ-hexachlorocyclohexane (Lindane)

Request Form for Reference Materials (RMs)

PART A – INFORMATION and DECLARATION

(To be completed by the organisation making a request for RMs produced by Government Laboratory (GL))

Organisation's Information

Name of Organisation : _____

Postal Address : _____

Name of Authorised Representative : _____ (Title) _____ (Given Name) _____ (Surname)

Telephone Number : _____ Fax Number : _____

Email : _____

RMs Requested

Code	RM
GLHK-11-29	Arsenic (total), Cadmium and Inorganic Arsenic in Rice

GOVERNMENT LABORATORY
7/F, Ho Man Tin Government Offices
88 Chung Hau Street, Ho Man Tin
Kowloon, HONG KONG

Survey on the needs of the local testing community

Objective of the survey: This survey is conducted by the Analytical and Advisory Services Division (A&ASD) of the Government Laboratory (GL). Your feedback will be valuable for improving and planning the services of the Laboratory. Please take a few minutes to complete the following questionnaire.

Data Privacy Statement: The information gathered from this survey will be used for the planning of future services. The information will be kept confidential and will only be released, if necessary, in aggregate form.

Q1 Technical Seminar

a. Which of the following seminar(s) recently organized or co-organized by GL have you attended?

- ❒ Metrology Workshop on Measurement Uncertainty (20 – 21 Jan 2022)
- ❒ Metrology Symposium 2022: “Metrology and Everyday Life” (12 Aug 2022)

b. If the following seminars are organized in 2023 (tentative dates are given), would you be interested in participating in?

- ❒ Food Testing Seminar: Measurement of ethylene oxide, veterinary drug residues in food (please suggest specific drugs in Question 4) (Q1/Q2 2023)
- ❒ Metrology Symposium (Q3/Q4 2023)

Q2 Proficiency Testing (PT) Scheme

a. Which of the following PT scheme(s) recently organized by GL have you participated in?

❒ Benzoic Acid in Fish Sauce (GLHK PT 21-04)

❒ Chemical Markers in Chinese Medicinal Oil (GLHK PT 21-05)

❒ Boric Acid in Food (GLHK PT 22-01)

❒ Propionic Acid in Flour Confectionery (GLHK PT 22-02)

b. If the following PT schemes are organized in 2023 (tentative dates are given), would you be interested in participating in?

❒ Salicylic Acid in Food (Q1/Q2 2023)

❒ Boric Acid in Food (Q1/Q2 2023)

❒ Propionic Acid in Flour Confectionery (Q1/Q2 2023)

❒ Chemical Markers in Chinese Medicinal Oil (Q3/Q4 2023)

c. For the following testing parameter(s) and/or matrices, would you think there is a need of PT schemes to be organized by GL for the local testing community?

❒ Metals in salt, food grade

❒ Assay of Chinese Materia Medica

Q3 Certified Reference Material (CRM)

Do you have any difficulties in acquiring the following CRM for your operation?

❒ Propionic acid in flour confectionery

❒ Toxic elements (e.g. As, Cd, Hg and Pb) in seafood

❒ Toxic elements (e.g. As, Cd, Hg and Pb) in botanical material (e.g. herbs)

❒ Others under Chinese Medicine/ Food test category (please specify in Q4)

Q4 Any other comments on the arrangement of technical seminar(s), PT scheme(s) and production of CRM offered by GL?

For enquiries, please contact:

	Dr. Kelvin, C.W. TSE
Email	cwtse@govtlab.gov.hk
Tel. No.	+852 2762 3854

Thank You!